National Institute of Environmental Health Sciences

Human and environmental impact assessment of postcombustion CO2 capture focusing on emissions from amine-based scrubbing solvents to air

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Year: 2010
Journal: Environmental Science & Technology. 44 (4): 1496-1502

Abstract:

Carbon Capture and Storage (CCS) has become a key technology in climate change mitigation programs worldwide. CCS is well-studied in terms of greenhouse gas emission reduction potential and cost of implementation. Impacts on human health and the environment have, however, received considerably less attention. In this work, we present a first assessment of human health and environmental impacts of a postcombustion CO(2) capture facility, focusing on emissions from amine-based scrubbing solvents and their degradation products to air. We develop characterization factors for human toxicity for monoethanolamine (MEA) as these were not yet available. On the basis of the limited information available, our assessment indicates that amine-based scrubbing results in a 10-fold increase in toxic impact on freshwater ecosystems and a minor increase in toxic impacts on terrestrial ecosystems. These increases are attributed to emissions of monoethanolamine. For all other impact categories, i.e., human toxicity, marine ecotoxicity, particulate matter formation, photochemical oxidant formation, and terrestrial acidification, the CO(2) capture facility performs equally well to a conventional NGCC power plant, albeit substantial changes in flue gas composition. The oxidative degradation products of MEA, i.e., formaldehyde, acetaldehyde, and ammonia, do not contribute significantly to total environmental impacts.

Source: http://dx.doi.org/10.1021/es902116r

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Unspecified Exposure

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Co-Benefit/Co–Harm (Adaption/Mitigation):

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

Health Impact:

specification of health effect or disease related to climate change exposure

General Health Impact

Intervention:

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Mitigation

Model/Methodology:

type of model used or methodology development is a focus of resource

Cost/Economic

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content